University of Bahrain

College of Information Technology

Department of Computer Engineering

TEST 1

ITCE 260: Circuit Analysis

Dr. Riyadh Al-Hakim

23 April 2013	Name:	Dept: CE
Time: 60 minutes	ID #:	Section: 1

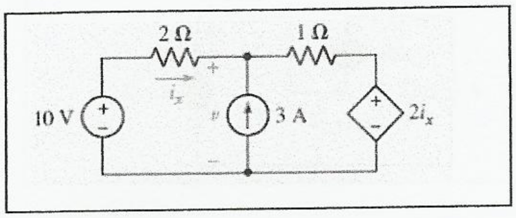
Show your WORK

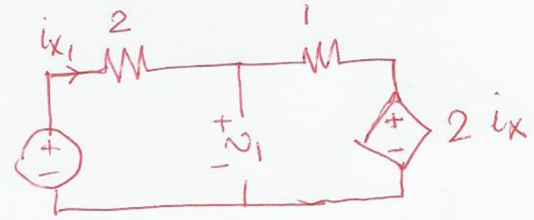
Q	Max Points	Distribution	Points Scored
1	28		
2	30		
3	30	Soln	
4	12		
Grade out of 100			

Show your WORK

Q1. Use superposition to find:

a) The current through 2 Ω resistor (i_x)
b) The voltage v across the current source



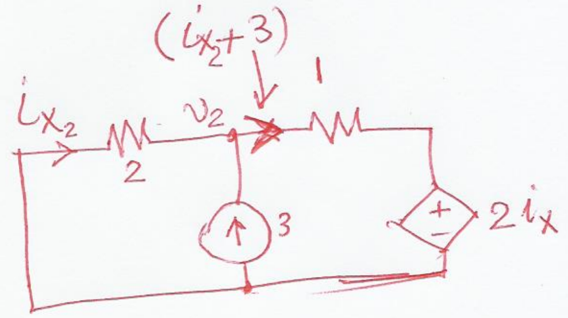


$$i_{x_1} = \frac{10 - 2\,i_{x_1}}{2+1}$$

$$3\,i_{x_1} = 10 - 2\,i_{x_1}$$

$$i_{x_1} = \frac{10}{5} = 2\text{ A}$$

$$\therefore\ v_1 = 10 - (2A)(2\Omega) = 6\text{ V}$$



outer mesh

$$2\,i_{x_2} + 1\,(i_{x_2}+3) + 2\,i_x = 0$$

$$5\,i_{x_2} = -3$$

$$i_{x_2} = -\frac{3}{5}$$

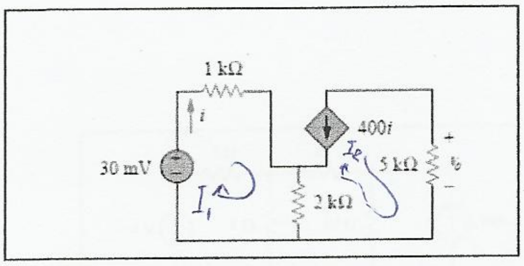
$$\therefore\ \boxed{i_x = i_{x_1} + i_{x_2} = 2 - \frac{3}{5} = \frac{7}{5} = 1.4\text{ A}}$$

$$v_2 = (-i_{x_2})(2\Omega) = -(-3/5)(2) = +\frac{6}{5}\text{ V}$$

$$\therefore\ \boxed{v = v_1 + v_2 = \left(6 + \frac{6}{5}\right) = 7.2\text{ V}}$$

30

Q2. In the following cct, determine:



a) v_o

b) Input resistance seen by the 30 mV source

Using mesh analysis:

#1 $-30mV + I_1(1K + 2K) - 2KI_2 = 0$ — ①

$I_1 = i$ — ②

#2 $I_2(5K+2K) - 2KI_1 = 0$ — ③

$I_2 = -400i$ — ④

by subst. ② and ④ in ① we get:

$-30mV + 3Ki - (2K \times -400i) = 0$

$-30mV + 3Ki + 800Ki = 0$

$803Ki = 30m$

$\boxed{i = 3.74 \times 10^{-8} A}$

∴ $V_o = 5K I_2$

$V_o = 5K \times (-400 \times 3.74 \times 10^{-8})$

$\boxed{V_o = -0.0748 V}$

R seen by 30mV source:

$R = \frac{V}{I}$

$R_{30mV} = \frac{30 mV}{I_1}$

$R_{30mV} = \frac{30 mV}{3.74 \times 10^{-8}} = 802.139 K\Omega$

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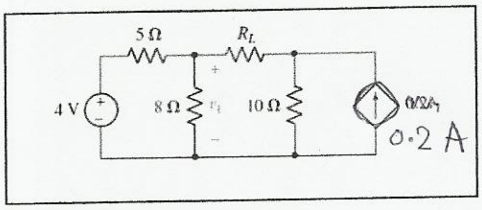
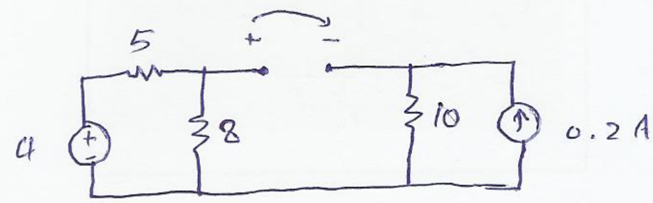
Q3

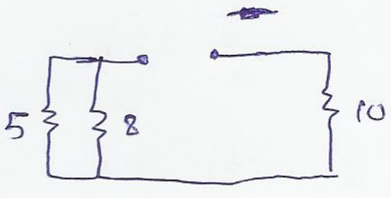
a) Find R_L which absorbs maximum power

b) Determine this maximum power



$$R_{eq} = 10 + 8 /\!/ 5$$





$$\text{Max } P = \frac{V}{4R}$$

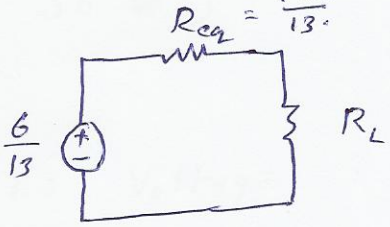
$$5 /\!/ 8 \Rightarrow R_{eq} = \frac{40}{13}$$

$$R_{eq} = 10 + \frac{40}{13} = \boxed{\frac{170}{13}}$$

$$V_{on\ 10\Omega} = IR = 10 \times 0.2 = 2\ V$$

$$V_{on\ 8\Omega} = \text{Voltagedevider} = 4\left(\frac{8}{5+8}\right) = \frac{32}{13}$$

$$V_{th} = V_8 - V_{10} = \frac{32}{13} - 2 = \boxed{\frac{6}{13}}$$



Max power wher $R_L = R_{eq} = \frac{170}{13}$

$$P = \frac{v^2}{4R_L} = \frac{\left(\frac{6}{13}\right)^2}{4\left(\frac{170}{13}\right)} =$$

$$= 4.1 \times 10^{-3}\ W$$

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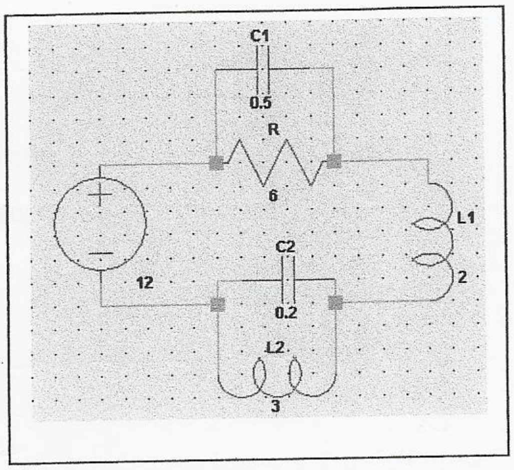
Q4. Find energy stored in each L and C of the following cct:

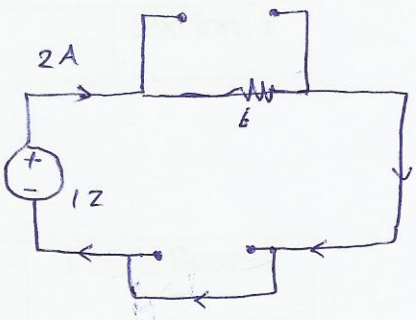


$$\mathcal{E} = \frac{1}{2} C V^2$$

$$\mathcal{E} = \frac{1}{2} L i^2$$

$$i = \frac{V}{R}$$

$$i = \frac{12}{6} = 2 \text{ A}$$



$$\mathcal{E}_{L1} = \frac{1}{2} L i^2$$

$$= \frac{1}{2} (2) (2)^2 = 4 \text{ J}$$

$$\mathcal{E}_{L2} = \frac{1}{2} L i^2 = \frac{1}{2} (3) (2^2) = 3 \times 2 = 6 \text{ J}$$

Voltage across capacitor 1 = V_R

$$V_R = IR = 2 \times 6 = 12$$

$$\mathcal{E}_{C1} = \frac{1}{2} C V^2 = \frac{1}{2} \left(\frac{1}{2}\right) (12^2) = 36 \text{ J}$$

$\mathcal{E}_{C2} = 0$ because there is no Voltage